WATERCRAFT PROVIDED WITH TWO FLOATING BODIES STACKED ON TOP OF EACH OTHER

[0001] This application is the U.S. National Stage of PCT/CH2004/000582, filed September 15, 2004, which claims priority from CH2003-01587/03, filed September 17, 2003, the disclosures of which are incorporated herein in their entireties by reference thereto.

BACKGROUND

[0002] The invention relates to a watercraft.

[0003] There exists a watercraft (i.e., boats and yachts) that is generally fabricated such that a lower section, called the hull, is composed of a hydrodynamically shaped section. The hull is dimensioned to have an appropriate wall height and wall thickness so as to resist strong wave action or grounding, and to allow as little water as possible to come over the deck. The upper section of the watercraft, called the deck, is a closing component of the hull and includes infrastructure for the watercraft, including living quarters and a helm, and an appropriate seal against the intrusion of water into the hull.

[0004] Located under the deck is a drive motor that is mounted directly on hull reinforcements. A propeller system is connected directly to the hull and includes a propeller bracket, Z-drive, jet drive, or outboard motor, rudder, motor cooling elements, and exhaust pipes. The hull and deck are usually glued, riveted or screwed together at the level of a sheer rail, with parts that join the hull and deck being elegantly concealed by the sheer rails.

[0005] A known aspect of watercraft is the fact that vibrations and oscillations caused by mechanical components and by wave action are transmitted to the entire watercraft shell, the latter acting as a giant resonance chamber. Simply placing the motor and transmission on rubber mounts partially reduces vibrations and oscillations.

[0006] Approaches to increasing passenger comfort in a watercraft are known, such as, for example, an external hull-section damping device as provided in U.S. Patent No. 3,270,701 or an internal hull-section damping device as provided in U.S. Patent No. 5,465,678. However, these do not meet specified requirements with regard to a reliable damping function and leveling.

SUMMARY

[0007] The invention thus provides, among other things, a reliable damping function and leveling of a watercraft.

[0008] According to an exemplary aspect of the invention, a watercraft includes at least two floating bodies; a drive device that drives the at least two floating bodies; and a

control device that controls at least the drive device, wherein the at least two floating bodies are stacked, the at least two floating bodies are connected by at least one connecting device, at least one damping device is located between the at least two floating bodies, and an intermediate space between the at least two floating bodies is sealed by a sealing device.

[0009] By dividing the watercraft into two floating bodies or hull sections, the hull section (the lower floating body) that has to bear the main hydrodynamic buoyancy function, load, and vibrations and oscillations generated by the machinery, as well as wave impacts, is isolated and is designed as an independent floating body that accommodates the motor, transmission, control elements, attachment device, etc. In addition, the second hull section (the upper floating body) is also designed as a separate floating body and performs secondary hydrodynamic functions, such as, for example, lateral routing of the water flow, as well as providing a living and work compatible space for the crew of the watercraft. The second upper hull section is attached in a saddle-mountable fashion via movable attachment elements to the lower floating body, the two floating bodies having a damping device between the two sections as well as a seal between the two sections to prevent water from impairing the damping function. Both bodies have a flexible coupling device that easily enables the power supply, electrical signals, steering device, motor power device, and reversing device to be interconnected.

[0010] Having two independent floating bodies not only enhances vessel safety but also provides a simple and cost effective way of limiting any vibrations and oscillations caused, for example, by the motor, transmission, and propeller to a defined space while as much as possible decoupling the space from the remaining space. In addition, other initiators of vibration and oscillations such as wave impacts and possible propeller cavitation impacts are also not transmitted to the entire watercraft.

[0011] Between the two sections, the two stacked floating bodies possess an elastic device that acts as a damping medium. This can be a compressible medium such as, for example, a rubber element or fillable expanding body, or a shock absorber system similar to those known from the automotive field.

[0012] Damping can be controlled either passively or actively by an appropriate electronic system, wherein in the case of active damping, the optimum damping rate is computed and adjusted by sensors. Active damping also allows the damping travel distance to be controlled such that the upper floating body can be raised so as to receive less spray from the water, or lowered in order to present the smallest possible profile to the wind.

[0013] In addition, the vibration damping can be made more sophisticated by having two individual control systems, a primary and a secondary system, such that the two control circuits communicate with each other so as to implement the best damping. The lower floating body control system primarily controls hydrodynamic motion, for example, via trimming and stabilizing flaps or side stabilizing fins, propeller drive angle adjustment, etc.

[0014] The upper floating body control system implements control, for example, through vertically acting hydraulic or pneumatic elements to ensure the most stable, horizontally oriented upper floating body.

[0015] In addition, a passive or active horizontal damping device can be used to filter impacts occurring on the lower floating body when entering waves, thereby further enhancing comfort in the upper section.

[0016] In addition, at least one movable and guided connecting element is present between the two body units so that the watercraft, comprising the lower floating body and the upper floating body, is held together, and so that they are moved neatly parallel to each other. However, the connecting element can also include a more complex, for example, cardan-type suspension system.

[0017] A seal of the intermediate space between the lower floating body and the upper floating body is required for the damping function to work properly. If water would collect in the intermediate space between the lower floating body and upper floating body, damping could no longer be ensured since the water is not compressible and must first be forced out to allow for a damping effect between the components. In response to a relief of damping, a vacuum might result, and water would be sucked into the intermediate space, thereby causing the watercraft to take on additional weight. For this reason, a circumferential, elastic and secure seal provided by an appropriate sealing device is a component of a reliably functioning damping device.

[0018] A suitable bilge pump ensures that even in the event of minor damage to the seal, any intrusion of water would be automatically expelled from the intermediate space.

[0019] In addition, a relieving line allows the volume differential in the intermediate space to be compensated during the damping process.

[0020] Additional advantageous embodiments of the invention are presented in the subordinate claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The following discussion explains embodiments of the invention in more detail based on the drawings. Identical elements in the various figures are provided with identical reference numbers.

[0022] Fig. 1 is a side view of a watercraft that has a lower floating body separated from an upper floating body;

[0023] Fig. 2 is a side view of a watercraft ready for operation that has the lower floating body connected to the upper floating body;

[0024] Fig. 3 shows a horizontally acting damping device;

[0025] Fig. 4 is a rear view of a seal relevant for damping located between the lower floating body and the upper floating body;

[0026] Fig. 5 is a front view of the seal relevant for damping located between the lower floating body and the upper floating body; and

[0027] Fig. 6 is a sectional view of the seal relevant for damping.

DETAILED DESCRIPTION OF EMBODIMENTS

[0028] Fig. 1 shows a watercraft comprising a lower floating body 1, an upper floating body 2, a motor 3, a drive unit 4, and a steering/control device 6, in a separated state. The lower floating body 1 of the watercraft can be hydrodynamically optimized for a specified load and travel speed. The upper floating body 2 is placed over the lower floating body 1 and can have any appropriate recess to meet the space requirements for the motor 3, living space, working space, a holding device 5, and the steering/control device 6.

[0029] The lower floating body 1 serves primarily as the main buoyancy body and preferably has an overall height that approximately corresponds to a level of the waterline when the watercraft is in the loaded state. In terms of construction engineering, a situation may arise in which a drive motor, and possibly the fuel tank, project above the waterline, with the result that these elements will need to be protected from possible contact with the water by an appropriately higher side wall.

[0030] Fig. 2 shows a watercraft ready for operation, wherein the lower floating body 1, that houses the motor 3, the drive unit 4, and a fuel tank 9, is connected to the upper floating body 2 by guide elements 7, attachment points 8, and damping devices (a passive damping device 10 and an active damping device 11, for example).

[0031] Also shown are the living space, working space, holding device 5, and the steering/control device 6 that can be connected by a coupling device 13 to the lower floating body 1 so that the steering/control and drive elements are able to interact with the

steering/control device 6. In addition, a sealing device 12 (which is an example of another damping device) is shown that seals off an intermediate space 14 from seawater and foreign bodies, the intermediate space 14 having an air exchanging device 15 and a bilge pump 16

[0032] The attachment of the lower floating body 1 to the upper floating body 2 is effected through the damping devices so that motor vibrations and oscillations, in addition to wave impacts, drive-unit vibrations, or propeller vibrations, are isolated from the upper floating body 2. The damping can be effected either by a passive damping device 10, such as an elastically compressible device or inflatable tubes, or by an active pneumatic or hydraulic damping device 11 that can additionally be controlled by an electronic system.

[0033] In addition, the active filling of the active damping device 11 enables the upper floating body 2 to be set higher or lower as required, while also allowing the damping travel to be increased or decreased independently.

[0034] The flexible coupling device 13 connects all technical devices related to making the watercraft operationally ready, the majority of which leads to the steering/control device 6, such as electric lines for the motor instrument displays, control lines for the trimming and stabilizing flaps, side thrusters, additionally separate power for the galley, cabin illumination, external markers of the watercraft, etc., as well as the mechanical connections such as, for example, transmission reversal, motor power and rudder function control. The steering/control device 6 advantageously includes the steering, power lever, transmission, displays, and actuators for the technical devices such as the trimming and stabilizing flaps, propeller adjustment, and the side thruster. The control commands and other functions indicated above may, if required, also be transmitted wirelessly, by radio; for example, between the two floating bodies.

[0035] In addition to the vertical damping device, a horizontal damping device is provided that enables an additional impact delay in response to entrance into waves. Fig. 3 shows a horizontally fixed passive damping device 10 and active damping device 11 that are attached on one end to the lower floating body 1 by an attachment point 8, and on the other end to upper floating body 2 similarly by another attachment point 8.

[0036] Figs. 4 and 5 illustrate the central sealing device 12 for the damping function between the lower floating body 1 and the upper floating body 2. In order to prevent the admission of both water, since this medium is incompressible and would therefore impair the damping function, and foreign bodies, such as mud and seal creatures, into an intermediate space 14 between the lower floating body 1 and the upper floating body 2, the sealing device

12, for example, includes a circumferential band that has been applied. The sealing device 12 can be designed so that it is able also to participate in the process given active leveling, for example, when large height differences are set between the lower floating body 1 and the upper floating body 2.

[0037] A relieving line in the form of an air exchanging device 15 allows for an exchange of air between the intermediate space 14 and the outer environment (atmosphere), and can also be employed for the function of the bilge pump 16 in response to an unwanted admission of water.

[0038] Fig. 6 shows the sealing device 12 and the connection of the two floating bodies 1, 2 in detail. The sealing device 12 here is designed, for example, in tubular form and is thus able to compensate for movements made by the two floating bodies 1, 2 relative to each other. The sealing device 12 can at the same time be employed as the passive damping device 10. The tubular sealing device 12 can be filled with air such that damping is able to be adjusted via the pressure, with the result that active damping can be generated even in the event of changes in the pressure during operation.

[0039] The lower floating body 1 is connected to the upper floating body 2 by the guide elements 7, attachment points 8, a guide device 17 and a stop 18. The ability of the two floating bodies 1, 2 to move relative to each other is limited by the guide device 17 and the stop 18. An additional passive damping device 10 can be advantageously located between the guide device 17 and the stop 18, thereby further damping the motion. It is of course also possible to design the sealing device 12 as a skirt or in a different form.

[0040] It is of course understood that the invention is not limited to the embodiment shown and described.